

mens): 14 to 17 (mean 15.9) labial; 16 to 19 (mean 16.8) columellar
 *C. coxeni* Cox, 1873

- 5a. Base dull; dorsum with numerous, fine, greenish-brown confluent spots; labial and columellar teeth extending to the margins; tooth count (based on 11 specimens): 14 to 17 (mean 15.3) labial; 12 to 17 (mean 14.5) columellar . . . *C. dayritiana*, spec. nov.

Acknowledgment

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of specimens, for preparing a detailed map of the type locality area, and most of all for his many valuable contributions to our knowledge today of the marine molluscan fauna of the Philippine area. I further want to thank James Norton and Robert Lee for so willingly lending their specimens; my appreciation for their consideration of the problem also goes to Rose Burch and Ray Summers, the latter also having kindly loaned pertinent literature; and to Emily Reid for her excellent adaptation of Mr. Dayrit's map into a textfigure. To Jean Cate, as always, goes my gratitude for her interest and assistance, so necessary to the success of this work.

An Unusual Occurrence of *Tresus nuttalli* (CONRAD, 1837) (Mollusca : Pelecypoda)

BY

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(3 Textfigures)

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In the course of making collections of late Pleistocene invertebrates from the lowest emergent marine terrace along the central California coast, the pelecypod *Tresus nuttalli* (Conrad, 1837) (= *Schizothaerus nuttalli*) was found nestling in a boulder riddled with holes of boring mollusks. The fixed confines of this unusual ecologic niche resulted in a unique departure from the characteristic shell morphology of this species. *Tresus nuttalli* is ordinarily found burrowing deeply in sandy substrates. It is an abundant species in fossiliferous late Pleistocene terrace deposits in this area. For many years it has been commonly, although improperly (Keen, 1962), referred to the genus *Schizothaerus*.

The boulder was collected from a lens of fine-grained, micaceous, fossiliferous sand of late Pleistocene age. In this area several lenses

of fossiliferous sand occur beneath large sandstone boulders and in depressions in the wave-cut platform. The locality is about 20 to 25 feet above sea level on a small point south of Cliff Drive approximately one-quarter mile west of Point Santa Cruz (near the S $\frac{1}{4}$ cor. SW $\frac{1}{4}$ of projected quad., 1954). The writer's interest was first drawn to this area by Bradley's report (1956) of a Carbon-14 date of more than 39,000 years on fossil shells collected from holes of rock-boring mollusks in the terrace platform west of the above described locality. Earlier collections from terrace deposits in the Santa Cruz area and to the northwest listed by Arnold (1908, pp. 355-356) included 32 species of mollusks, principally gastropods. Arnold's field notes indicate that the present locality is equivalent to his locality "near the light-house at Santa Cruz" (*ibid.*, p. 355).

The nestling specimen of *Tresus nuttalli* was found in a light grey, very fine grained, calcareous sandstone boulder measuring five inches in diameter. Borings in the well-rounded boulder are ovoid or egg-shaped with the broadly rounded, larger end toward the center of the rock (Fig. 1). Judging from the dimensions and size of the holes, the principal original boring organisms may have been *Penitella penita* (Conrad, 1837) or *Zirfaea pilsbryi* Lowe, 1931. Several specimens of these rock borers have been collected *in situ* by the writer from burrows in hard Miocene shale forming the low-lying Pleistocene wave-cut platform near Point Año Nuevo about 20 miles to the northwest. Varying degrees of exposure of original borings indicate

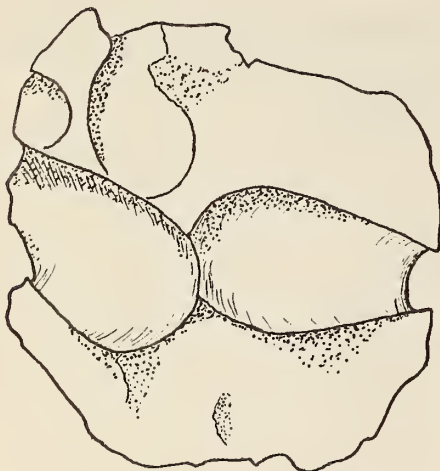


Figure 1: Interior of sandstone boulder (x 0.8) showing cavity, to the right, occupied by *Tresus nuttalli* (CONRAD, 1837)

that the boulders resting on the terrace platform were greatly reduced in size by marine abrasion. In some cases only a trace of the anterior or innermost part of the original ovoid cavity remains. Pholads were not found in any of the boulders examined in this area. Rather, the cavities were occupied by paired valves of the nestling pelecypods *Petricola carditoides* (Conrad, 1837) and, in lesser numbers, *Protothaca staminea* var. *runderata* (Deshayes, 1853). The gastropod *Crepidula nummaria* Gould, 1846, was also found nestling in borings in the boulders.

The unusual shape of the specimen of *Tresus* produced by confinement to the rock cavity is shown in Figures 2 and 3. Superficially, it

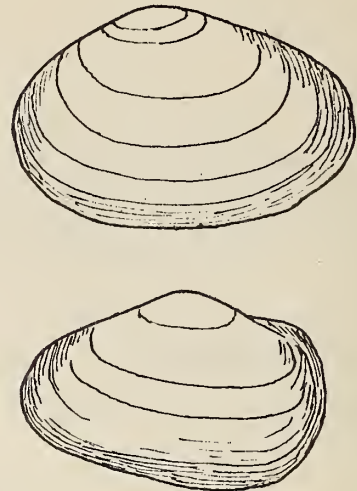


Figure 2: *Tresus nuttalli* (CONRAD, 1837) External view of normal specimen (x 0.8, above) and nestling specimen (x 1.2, below), left valves

resembles the commonly occurring *Petricola carditoides* more closely than typical specimens of *Tresus nuttalli* occurring in the same deposit, yet the distinctive fine external radial ribbing of the former permits ready external discrimination between the two species. Early concentric growth lines indicate a normal, subquadrate shape, yet the "adult" shell (0.8 in. high and 1.3 in. long) is ovoid in outline. At a critical stage in growth, the organism assumed an unusual position with the anterior end oriented toward the outer portion of the burrow. Although the posterior, siphonal end was directed toward the inner part

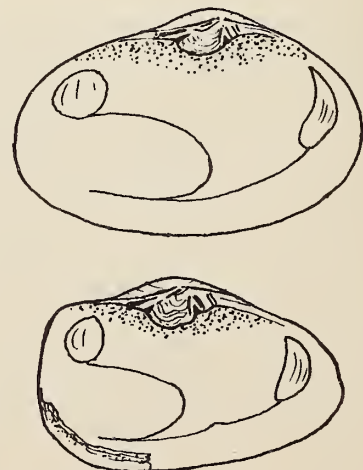


Figure 3: *Tresus nuttalli* (CONRAD, 1837) Internal view of normal specimen (x 0.8, above) and nestling specimen (x 1.2, below), left valves

of the cavity, an ovoid burrow from the opposite side of the boulder intersected the hole in a manner which provided a small window through which the siphon could be extended (see Fig. 1). This enabled the clam to carry on normal filter-feeding activities although lodged "in the wrong direction" in the burrow.

This limiting ecologic niche so altered the shape of the shell that the position of the beak is medial rather than from one-third to one-fourth the distance from the anterior to the posterior end. The anterior end is pointed while the posterior end is broad and truncate, whereas in several normal specimens of *Tresus nuttalli* collected from the Santa Cruz locality, the posterior extremity is somewhat pointed while the anterior extremity is rather broadly rounded. The dentition and pallial markings on the inner surface of the valves, as well as the posterior gape for the siphons, compare favorably with normal specimens of this species.

Tresus nuttalli is usually found burrowing in sandy substrates, to considerable depths in the adult stage of development. The burrows are perpendicular to the surface. It is a common member of the burrowing fauna in sandy tidal flats near the mouth of Elkhorn Slough, 18 miles southeast of Santa Cruz, where it is ac-

tively sought by clam diggers. The species is found living, often in great abundance, in bay or estuarine and protected outer-coast environments. The bathymetric range is from the intertidal zone down to depths of 100 feet or greater (Fitch, 1953). The geographic range is from the Straits of Georgia, British Columbia (Quayle, 1960), to Scammons Lagoon, Lower California (Fitch, 1953).

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Notes on the California Species of *Aplysia* (Gastropoda : Opisthobranchia)

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In preparation for the forthcoming key to the California opisthobranchs, it has been necessary to attempt to resolve some of the problems concerning the distribution and systematic status of the *Aplysia* of California. This information is published here to avoid bulk in the key's text. The subgenera given are those used by Eales (1960) in her revision of the world species of *Aplysia*.

1. Subgenus *Pruvotaplysia* ENGEL, 1936

Eales (1960) and Baba (1949) have indicated that California is included in the range of *Aplysia parvula* Guilding in Mörch, 1863. The only record of an actual collection from any point near to California seems to be that (as *Tethys*) of MacFarland (1924). He reported on three